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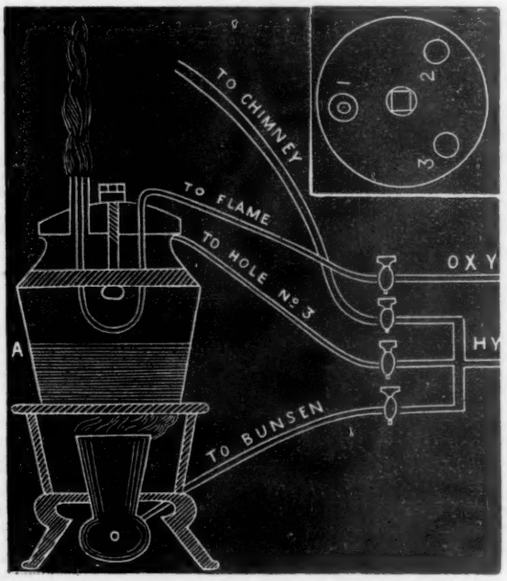
The Phosphoric Light.

The apparatus consists of an iron vessel, A, into which sticks of phosphorus are introduced. That used at the Manchester Photographic Society's meeting was five inches in its largest diameter and three and a half inches in depth, having a capacity of twenty-eight fluid ounces. This vessel is fitted with an irrocover of substantial thickness, ground so as to fit air tight to it, and secured in its place, when required, by a cross bar inside, fastened with a bolt and nut. Three other holes are also bored through this cover, as seen in Fig. 2, that marked No. 1 being half an inch in diameter, and having a piece of brass tube about an inch long screwed into it, with a narrower tube inside. This is the jet through which the phosphorus vapors issue, and the smaller tube conveys the oxygen required to supply the flame, the oxygen passing through the tube, entering the hole 2, and being conveyed as seen in Fig. 1, through the vessel, A, containing the phosphorus, up through the middle of the jet at which the phosphorus vapors are burned. It is indispensably necessary that the oxygen should not escape into the vessel, A; for if it did combustion would take place in the vessel itself, and would probably lead to an accident. The other hole, 3, is for occasional use, and is fitted with a pipe for the introduction of common coal gas under such circumstances as will be hereafter mentioned. The vessel, A, is placed upon a stand over a large Bunsen burner, and with it is enclosed in a capacious lantern, furnished with plain glass front, and with silvered reflectors behind. The lantern is also supplied with a chimney communicating with the outer air, and having a gas burner inside it to produce a strong up draft before commencing to experiment.



When all is arranged, three or four ounces of the element phosphorus are thrown into the chamber, A, and the lid screwed down. The apparatus is then placed in the lantern, and the Bunsen burner beneath it is lighted. The phosphorus inside soon melts and inflames, burning until the oxygen in the chamber is consumed, and causing the emission, at the jet, of a small quantity of white smoke (phosphoric anhydride). After a white ebullition takes place, and bright flashes of flame spontaneously appear at the nozzle. If the heat be sufficiently applied the flame becomes continuous, and extends in hight in proportion to the rapidity with which the gaseous phosphorus is evolved, burning with considerable brightness. If, however, sufficient heat be now applied to make the flame quite continuous, and a current of common coal gas be passed directly into the chamber through hole 3, this gas and the phosphorus become associated together, and burn at the jet with a brilliant flame entirely under the control of the experimenter. When the experiment was performed before the Manchester Photographic Society, this flame varied between fifteen and twenty inches in hight; and upon the introduttion of the oxygen, its brightness became so greatly augmented as to render it almost unbearable to the eye. The readers of this journal may judge for themselves whether or no a room is not brilliantly illuminated by a flame eighteen inches in length, and so bright throughout the whole of that eighteen inches as to be almost unbearable to the sight. When the writer says the illumination of a room by this light is far greater than is possible by a single oxyhydrogen light as ordinarily employed, he is not making any idle boast of one inflated with his own idea, but is simply stating what was proved to be the fact at the most numerously attended ordinary meeting ever held by the Manchester Photographic Society.

In making use of the apparatus here described, the writer found it convenient to have all his taps near together, as shown in the diagram, so that, without moving about, it would be possible to increase or diminish the heat beneath the phosphorus chamber, accelerate or lessen the draft in the chimney, augment or suppress the supply of hydrogen to the chamber, and add to or take from the quantity of oxygen introduced into the flame.

What efforts have been made for the commercial introduction of the phosphoric light have, thus far, been unavailing, because of the strong prejudices which are entertained against the use of phosphorus. It is true, an accident with this substance might prove a very disastrous affair, as accidents with gunpowder and steam have proved; but gunpowder, steam, and phosphorus, may all be used, in suitable appliances and with ordinary care, with a very small amount of fear of any mischance.—*British Jour. of Photography.*

Steam for Street Cars.

The *American Artisan* gives the following description of the ingenious new plan of Mr. Baxter, who believes he has overcome all the practical difficulties:

"Two or more cylinders are arranged in such manner that the steam from one may be exhausted into and used expansively in the other, a steam chamber or space so connected with the boiler or cylinder, that, first, it will receive the exhaust steam from one cylinder and transmit it to the other, where it is used expansively. Second, it will, when the engine is at rest, accumulate the steam generated by the boil until the steam it contains stands at the same pressure as that in the boiler, and will, when the engine again moves, transmit this steam to the cylinder which ordinarily receives the exhaust steam, whereby both cylinders will have the same or nearly the same steam pressure in starting the car, thus furnishing the extra or reserved power necessary to put the car in motion. Third, should a heavy or long up grade be encountered, requiring a long-continued increase of power, communication between the steam chamber and the boiler may be opened so as to permanently, or for as long a period as required, increase the pressure in the exhaust cylinder to the extent desired. Fourth, should this power be insufficient, it may be still further increased by cutting off the exhauststeam of the first cylinder from the second, in which it is ordinarily used expansively, and opening communication between the steam chamber and boiler, using live steam at full pressure in both cylinders, making both of them high pressure for the time being, Thus, with an engine of say four horse-power nominally, it will be perceived that the power can be increased from that point up to twenty or twenty-four horse-power, as would be the case when both cylinders use live steam."

In one of the Paris water-pipes, 3,120 feet long, M. Biot was able to keep up a conversation in a very low tone with a person at the other end.

New Gas Company.—Jersey City is to have a new gas-light company with a capital of $2,000,000.

Chemical Repertory,

No. 65.—March 2, 1872.
EDITOR—HENRY WURTZ.

CHEMICAL EXCERPTS.

177. Maury Outdone.—Captain Silas Bent has been explaining to an appreciative audience in St. Louis his theory about "the thermometric gateways to the pole." The Captain finds in the record of recent explorations in the Arctic regions ample confirmation of his opinion about the existence of an open polar sea, as well as of the proper course to be taken in reaching it. This open sea he holds to be simply the termination of the north-east branch of the Gulf Stream, and consequently it is by following the course of the heated current from the equator that the pole can be discovered. Among other things, Capt. Bent alluded to the startling hypothesis, that to reduce Northern Europe to a frozen wilderness, we have only to make a big enough cutting in the Isthmus of Panama to send the surplus equatorial current of the Atlantic into the Pacific, instead of having it diverted, as now, to the shores of Europe. As the cost of reducing in this way England, Germany, and Northern Europe, to their natural climate level—that of Labrador—would be two or three hundred thousand millions of dollars, there is no immediate necessity for the Powers of the Old World revolving how to anticipate us in the possession of the Isthmus of Panama.

In "Notes on Fire-Brick" read recently to the "Corps of Royal Engineers," by Lieut. G. E. Grover, we find the following:

On Testing Fire-Bricks.—In many works there is adopted the rough and ready, but very efficient mode of comparing the relative qualities of fire-bricks by placing them side by side upon the bridge of a reverberatory furnace, where they are subjected to the same heat and the same corrosive action of the fuel; and show very clearly, after a few days or weeks firing, which brick can best withstand these destructive influences under precisely similar conditions. I think this test is even superior to those suggested above. The corrosive action of suspended coal-dust in fluxing and gradually cutting away the exposed surfaces of brickwork, is extraordinarily great, even superior to the disintegrating inflence of extreme heat.

179. Lillie's Automatic Fire-Extinguisher.—The ordinary fire-extinguisher requires that some one shall drive down a plunger into the reservoir, by which acid is brought in contact with some carbonate, and carbonic acid is liberated, which, being directed upon ignited matter, extinguishes the fire.

Mr. Lillie proposes to keep his extinguishing gas ready condensed in reservoirs, and to have these reservoirs connected with the various rooms of a building by pipes, and in case of a fire the melting of a fusible metal plug would let out the gas and stop the conflagration. He uses ammonia, carbonic acid or sulphurous acid. Either of these will put out a fire. To obviate the objection, that the heat would have to be inconveniently high to melt the plugs, Mr. Lillie has recourse to the device of a thermometer attached to a galvanic battery, and when the heat reaches a certain point the connection is made, and the current of electricity, passing through a platinum wire, ignites some combustible put in a cup under the plug, and thus the fusible metal is melted indirectly by a much lower temperature. The invention involves the necessity of retaining compressed gases in tight reservoirs for indefinite periods of time, but if that can be accomplished, has many favorable points to commend it.

180. Interesting to Posterity.—When we have got so far as to make one tun of coal go as far and produce as much useful effect in the process of combustion, however applied, as, say on a moderate estimate, eight or ten tuns do now, then, or even simultaneously, the question of supply may assume an importance that it does not as yet possess, in comparison with that of efficient and economical utilization. Nothing can be more certain than that, if these stages of improvement are not voluntarily sought for and anticipated, they will be forced upon us as matters of necessity, in proportion as coal, through wasteful use, becomes scarce and dear. But with the improvements and economies desired, the bulk of the supply would remain to be devoted to the smelting and refining of metalliferous ores and metals, for which it is, and must remain, essential.

181. Ground Tea.—A French chemist asserts that if tea be ground like coffee before hot water is poured upon it it will yield nearly double the amount of its exhilarating qualities.

182. Fire-Proof Composition.—An important trial of fire-proof composition has been made at the Washington Navy Yard by direction of the Secretary of the Navy and the Secretary of the Treasury, under supervision of A. B. Mullett, Esq., Supervising Architect of the Treasury. Two trials were made, one in the reverberatory furnace and one in the blast furnace. Both were eminently successful. The last resulted as follows:

An iron chest, 16 inches in diameter, with a lining of six inches of the composition, also containing a wooden box, four inches in diameter, in which were deposited papers, money, and matches, was placed in the blast furnace, and different metals placed all around it, after being subjected to an almost continuous blast of three hours; and after all the metals were melted, the chest was left in the furnace until this morning. To-day at 1 o'clock P. M., under direction of the representatives of the Government, the three chests were opened and the contents were found to be in exactly the same condition as when they were put in, and the matches were used to light cigars with. The fire-proof composition is the discovery of two gentlemen from Detroit, one of whom, Sigismund Rothschild, was present at the trial.

[It is very unlikeiy that any especial "discovery" is here involved. So long as not contiguous to iron or other substances that will slag it down, six inches of common firebrick would do all the protecting accomplished in these experiments. In this case, however, on account of the iron chest, a chemist would make use of anhydrous magnesia, or alumina, or even quicklime, without resorting to any "composition," or needing to exercise any unusual amount of invention.—Ed.]

183. Screening Flame.—M. Laborde has made some suggestive experiments. He let a thin thread of water pass through the jet from the blowpipe, and he found on examination that the water, which had thus passed through a heat capable of melting almost any metal, was but slightly warmed; in fact, the difference was but three degrees. If a jet is passed through an ordinary flame, the increase in temperature is considerably higher, probably owing to the incandescent particles carried away by the liquid from the smoke. A sheet of water presents similar evidence. If the jet from the blow pipe is directed against it, it is not pierced, nor is there any sensible heating effect. The finger can be brought to within a few millimeters of the flame, and yet there is no sensation to indicate the close proximity of an otherwise so potent source of heat. It is suggested that if, instead of the metallic curtain used in theatres in the case of fire, a sheet of running water were interposed, so as totally or partly to enclose or shut out the fiery element, it would be an improvement upon the system at present adopted. —*Sci. Am.*

184. Melting Points of Metals.—

Name.	Melts.	Boils.
Aluminum	700 deg. C.	
Antimony	425 "	
Arsenic (fusible only under high pressure)	412 "	412 deg.
Bismuth	270 "	
Cadmium	320 "	860 "
Calcium	?	1,040 "
Copper	1,050 "	
Cobalt, about	1,050—1,200 "	
Gold	1,250 "	
Indium	176 "	
Iron, cast	1,050—1,200 "	
Iron, wrought	1,500—1,690 "	
Iron, steal	1,200—1,400 "	
Lead	330 "	1,040 "
Lithium	180 "	
Magnesium, about	230–235 "	
Mercury	40 "	350 "
Nickel, about	1,500—1,600 "	
Platinum	2,600 "	
Potassium	62.5 "	
Selenium	217 "	700 "
Silver	1,000 "	
Sodium	96 "	
Tellurium	380 "	
Thallium	290 "	
Tin	235 "	
Zinc	412 "	1,040 "

—*Jour. of Applied Chem.*

[To reduce the above Centigrade degrees to Fahrenheit multiply by 1.8 and add 32°. With regard to the above figures, it must be remembered that the higher ones cannot be determined as yet by any direct means, and can be but approximations.—Ed.]

185. A Test for Silk Fabrics.—The *British Trade Journal* states that Mr. John Spiller, in the course of some investigations made last year, found that hydrochloric acid was an energetic solvent of silk, although it left wool and cotton unacted on, for a lengthened period. The practical bearing of this discovery was exemplified by the immersion of several so-called pure silk ribbons and other fabrics in the acid, when the silk was dissolved away, leaving the threads of the adulterating material intact: Thus by obtaining a small sample, and immersing it for a few seconds in the hydrochloric acid, or preferably by dropping a little of the acid on the centre of the sample, if it be pure silk a hole will be produced; but, if impure, the threads left will immediately indicate the nature and extent of the adulteration.—Dr. Walz, in *Industrial Record.*

186. A "Case of Conscience" Extraordinary.—A Richmond journal asserts that the gas inspectors in that city have recently been called upon by a citizen, a prominent physician, who insisted that his gas bill was too light! Examination showed that the meter was not working. Doubtless the bills will hereafter be made sufficiently heavy to satisfy even his ideas of justice. Usually gas consumers are not prone to enter complaints if the mistakes are in their favor.

Our Gas Companies.

[From the Correspondence of the *Times.*]

[Of course we give this but for what it may be worth, not knowing what proportion of the statements are reliable.—Ed.]

To the Editor of the New York Times.

I have recently read in your paper several communications complaining of the impositions of the gas companies in this city. I have seen nothing in relation to a little piece of science on the part of the Manhattan Gas Company, which has aided it in making the generous dividends which its shareholders receive. As some of your subscribers who pay tribute to it may be ignorant of the facts, I propose to call your attention to them.

The Manhattan Gas Light Company was incorporated in 1830. Its capital was increased in 1837 to $1,000,000. In 1855 it applied to the Legislature to increase its capital to $2,000,000. An act was passed authorizing it to increase its capital to that amount, but, as a condition, providing:

"Said company shall supply to every inhabitant of the said city of New York who shall request it, and who shall pay for the same, such inflammable gas made by them as he or she may require, provided said gas is required where the mains or pipes of said company are now or may hereafter be laid, at a price not exceeding $3 per thousand cubic feet for the period of one year after the adoption of the resolution, [to increase the stock,] and upon the expiration of that period to a price not exceeding $2.50 per thousand cubic feet." [See laws of 1855, chap. 543, page 1,038.]

The resolution was passed, and the company then reduced the price to $2.50: but by way of showing the Legislature how smart they were, and how they could wriggle around the law, they charged not only the price of the gas, but in addition to that a monthly rent for the meters they used to measure it. This amounted in the case of a great majority of their customers to about as much as if the price were $3 per thousand feet. To prevent this extortion, chap. 253 of the laws of 1866 was passed as follows:

"On and after the passage of this act, it shall not be lawful for any gas company in this State to charge or collect rent on its gas meters either in a direct or indirect manner. Any person, party or company violating any of the provisions of this act shall be liable to a penalty of fifty dollars for each offense, to be sued for and recovered in the corporate name of the city or village where the violation occurs in any Court having jurisdiction, and when collected to be paid into the treasury of said city or village and to constitute a part of the contingent or general fund thereof."

The simple-minded Legislature did not know how sharp the Manhattan Gas Company was. Presto, it gave up its charter and reorganized under the general laws for incorporating gas companies, and raises its charges for gas to $3 per thousand feet.

This was very smart. The company thus increased its receipts one-fifth, and continues the charge until this day. Now as the prices of coals for making gas have fallen more than one-half, the unfortunate owners of its stock, who can sell their shares at from 200 to 400 per cent. of the par value lose nothing by the attempt of the Legislature to interfere with their natural desire to have their dividends doubled. Of course, the good-natured consumers had just as lief pay $3 per 1000 feet as $2.50, or even $2, because they know that somebody profits by the difference.

A Consumer.

A Lecture on Water.

By CHARLES F. CHANDLER, PH. D.,

At the Academy of Music, New York, Jan. 20, 1871.

[Reported stenographically by S. J. Borrows, Esq.]

[Abstract by the Editor of this Journal.]

[Continued from page 52.]

FILTERING WATER.

Filtration is one of the simplest methods for purifying waters; its action is limited to the suspended impurities, such as mud, animal and vegetable substances, etc. Any porous material may be employed in the construction of a filter, the selection being generally governed by the magnitude of the operation. For city supplies, reservoirs are constructed which are provided with porous partitions, or so arranged that the water is obliged to percolate through beds of sand and gravel. I hold in my hand a very simple filter, which has recently been devised for domestic use.

THE TRIPLE FILTER.

FIG. 1.

It contains, in the first place, a little cup filled with coarse charcoal and sand, and provided with a net-work of wire gauze. Above that is placed a common sponge pressed firmly into its place so that it entirely fills the space. This is encased in a little perforated cup and is placed over the charcoal vessel. The water which passes through this is, therefore, obliged to pass through the sponge, and then through the charcoal. Although it acts as a perfect filter, it does not seriously interrupt the flow. The advantage of this filter is, that when it becomes clogged, and the flow of the water is impeded by the impurities separated, it is merely necessary to open it and take out the sponge, wash it and return it to its place. I have here a little bottle of impurities which were filtered out of the Croton, in a comparatively short time by one of these filters.

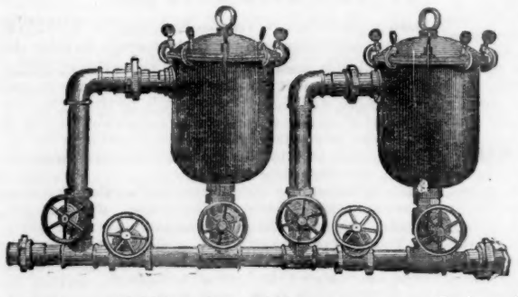
Fig. 2 is a house filter without the sand and charcoal cups, containing the sponge only.

FIG. 2.

HOUSE AND BASIN COCK FILTERS.

Filters are constructed on the same principle for use in manufacturing establishments. Fig. 3 represents one suitable for a large factory or hotel.

FIG. 3.



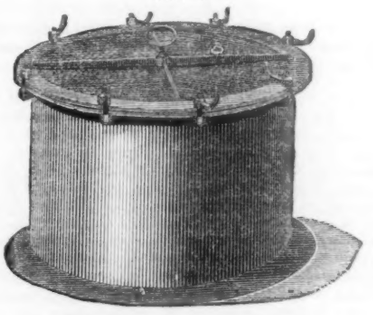
CONSTANT STREAM FILTER.

As there are really two filters, either one may be cleansed without interfering with the flow of water through the other, as you see by the arrangement of the cocks.

Here is a much larger filter, containing six chambers for holding sponges, each six inches in diameter, which is designed for paper factories where large quantities of water are used.

Still larger filters are constructed upon the same principle, up to a capacity of 800 gallons of water per minute. The sponges in every case completely remove the animal, vegetable and other suspended impurities.

FIG. 4.



STEAM PAPER MACHINE FILTER.

Another filter which is often attached to faucets in houses, is the common sand filter. It is attached in the same way as the sponge filter (fig. 2.), and by and by when it becomes clogged, it is merely necessary to reverse it, when the first glass of water passing through, cleans it. This does not permit so free a flow of water as the sponge filter, and moreover, it is liable to become permanently obstructed by impurities.

In many European cities, filtering basins of great size are employed for filtering the entire water supply. Filtering beds are constructed, many feet thick, consisting of layers of large stones at the bottom, smaller stones above, and finally coarse sand at the top. Galleries arched with brick, serve to receive the filtered water, which is then ready for distribution. The river waters supplied to London, Liverpool, York, Dublin, Edinburgh, Lyons, Marseilles, Genoa, Leghorn, Berlin, etc., are thus purified.

In this country, the system of filtering river water, is being now introduced at St. Louis, Schenectady and elsewhere.

Many families now make use of rain water, which is received in a cistern provided with a filtering partition.

BOILING WATER.

Impurities of animal and vegetable origin, are often rendered inert and harmless by simple boiling, and travelers in malarious countries consider this simple precaution a very efficient protection against some of the diseases peculiar to the localities.

DISTILLATION.

Distillation is really the most effective method for purifying water, but it is only applicable in special cases. The analytical chemist, the photographer, and sometimes the pharmaceutist are compelled to resort to distillation to obtain water sufficiently pure for certain of the operations incident to their respective professions. We have already alluded to the use of condensers on steamships. Almost all vessels are now provided with an apparatus by which the sea water may be distilled for drinking purposes in case of a long voyage and deficient supply of fresh water.

Distilled water must be thoroughly aerated, to render it palatable and wholesome.

OTHER METHODS OF PURIFYING WATER.

Charcoal has the property of purifying water contaminated by organic matters. On this account, water-casks are generally charred on the inside to the depth of an eighth of an inch or so, and it is a common practice when rain-water cisterns become foul, to throw in a bushel or two of fresh charcoal.

Permanganate of potassa, commonly called chameleon salt, is very effective in destroying organic matter in water. Travelers are advised to carry with them a small vial of crystalized salt. A small particle added to a glass of water, renders it pure, as in a few moments it oxidizes or burns up the impurities, which taken into the system might produce fever or dysentery. Running streams undergo purification by the oxygen which they absorb from the air.* Very impure waters when placed in casks on shipboard frequently undergo a kind of fermentation by which the impurities are worked off, and the waters rendered sweet and wholesome. This phenomenon has been noticed in the case of Thames water. Contact with iron, as when water is stored in iron tanks, effects a speedy purification. Filtration over magnetic oxide of iron is said to purify water very rapidly.

WATER FOR DOMESTIC PURPOSES.

For domestic purposes the water of springs is generally selected, because it is cool and clear, having undergone a natural underground filtration; but, as already shown, spring water generally contains a larger quantity of dissolved impurities, hence it is generally harder than river or pond water. Ordinarily wells receive their supply of water partly from springs and partly by drainage. They are, therefore, very liable to be contaminated with the soluble impurities of sewage, and frequently serve to disseminate special diseases, such as cholera and typhoid fever. I have in these jars a sample of such a well water, and will show you some of the peculiar impurities which it contains. To the water in this first jar we will add some of what is called Nessler's solution, a compound of iodide of mercury, with iodide of potassium. You see the liquid has assumed a deep orange color, a proof that the water contains a considerable amount of ammonia. In this jar is some of the same water, which has been previously concentrated and mixed with strong sulphuric acid. Now, on adding to this protosulphate of iron (copperas) you see a deep brown color is produced. This is due to the nitrates and nitrites which are contained in the water. Both the ammonia and the nitrates are derived from infiltrations of animal matter, from the soil around the well. In the water of a clear and delightfully cool spring, highly prized by the people of the neighborhood, which flowed from a side hill adjacent to a graveyard. phosphate of lime was found by suitable tests, which was derived undoubtedly from the bones of the departed.

Deep artesian wells, which bring water from deep lying strata, supplied from a distance, are free from organic impurities, though they often contain so much mineral matter as to give them medicinal qualities. This is the case with Dupont's artesian well in Kentucky.

One of the most celebrated fresh water artesian wells is that at Grenelle, a suburb of Paris. It is 1798 feet deep, cost $72,500, and supplies nearly 900,000 gallons daily. The water is received in a reservoir near the Pantheon, and distributed to the adjacent parts of the city.

Numerous wells of this character have been bored in London, into the chalk beds, which are from 350 to 550 feet deep, and furnish very wholesome water.

Recently, the tube or drive well has become quite popular; a simple iron tube or pipe is driven down through the soil, and in some cases a continual flow of water is obtained, otherwise, a pump is applied, but of course drainage water is obtained, though not to the some extent as in an open well The drive well is, I believe, an American invention; it was extensively employed by the British army in Abyssinia.

For the supply of water works of cities and large towns, ponds or rivers are resorted to, as furnishing the purest water in sufficient quantities, though, in a few cases, artesian wells have been relied upon.

CHARACTERISTICS OF A GOOD DRINKING WATER.

The characteristics of a good drinking water may be enumerated as follows:

Its temperature should be at least 10 degrees lower than the temperature of the atmosphere, but it should not be much lower than 45 deg. Fahrenheit.

It should be free from taste, except, perhaps, a slight pungency from oxygen and carbonic acid, which is an advantage. Taste is, however, a poor guide. When one becomes accustomed to a certain water, pure water tastes flat by comparison; fifty grains of chloride of sodium in a gallon would hardly affect the taste perceptibly.

A third requirement is freedom from smell. This should not be apparent, even when a bottle is half filled with water, placed in a warm place for a few hours, and then shaken.

It should be transparent; not that it is necessarily injurious if not transparent, but it is preferable to take our solid food in other forms. Sometimes water may contain peaty matter from swamps, or vegetable matter from new reservoirs, which is not necessarily unwholesome.

With regard to the total quantity of impurities admissible in good drinking water, the sanitary congress which met at Brussels decided that water containing more than thirty-five grains of impurity in one gallon is not wholesome, and that there should not be much more than one grain of organic matter. Thirty-five grains is a large quantity for city water, though well waters frequently contain more.

EFFECT OF MINERAL IMPURITIES.

The quality of the impurities is more important than the quantity. It is found that five or six grains of lime or magnesia render water unfit for the cooking of leguminous vegetables. On the other hand, it is a great advantage in making tea or coffee to use water of about five degrees of hardness; that is, containing

* We are here impelled to demur, or rather, perhaps, we should say, to qualify somewhat, the dictum of the learned lecturer. It has long been our conclusion, that the great mass of the organic impurities imparted to water, by drainage for example, including probably the germs of typhoids and dysenteries, are *not* destructible by atmospheric oxygen, but that life itself only is able to destroy these life-destroyers; that is, that either animal digestion, or, possibly, *active* oxygen, product of plant-life, must come into play.—ED.

about five grains of carbonate of lime or its equivalent in the gallon. A person of very nice taste can tell the difference in tea or coffee made with water in which the difference is not more than two to three grains of lime or magnesia to the gallon. It is on this account that certain wells have a great reputation as "tea wells." In olden times there were two or three such wells in New York, and a boy was kept by the corporation to pump water for the benefit of the natives. The fine flavor of the tea made with such water is due to the fact that the five or six grains of carbonate of lime prevent the water from dissolving the astringent matter contained in the tea, without interfering with the extraction of the theine and the other desirable constituents of the leaf.

Dr. Letheby, one of the highost authorities on the sanitary relations of water, considers water of moderate hardness preferable to very soft water for domestic purposes. About six grains of carbonate of lime per gallon is desirable. He finds that the death rate is less in cities supplied with moderately hard water, than in those supplied with soft water.

Magnesia in large quantities is objectionable, as are also lime salts. They are liable to cause dyspepsia. It is said that horses acquire a rough coat if supplied with water containing a large quantity of sulphate of lime. Goitre and cretinism are attributed to these impurities in the water; at least the facts observed make this reference extremely probable. The goitre appeared in the Durham jail, afflicting a large proportion of the convicts. The spring water with which they were supplied was analyzed, and found to contain seventy-seven grains of lime and magnesia salts per gallon. On substituting for this, a water containing only eighteen grains of these salts, it was found that the old cases rapidly improved, while no new cases made their appearance. In the limestone districts of England, Switzerland and central New York, this goitre has been traced over considerable areas. At Goruckpoor, in India, where the waters are quite calcareous, ten per cent. of the adults are afflicted with goitre, and many of the children are afflicted with cretinism. Even the cats and dogs are said to be afflicted with cretinism, which is a kind of idiotic insanity. It is a curious fact that in Ireland, on the Waterford side of the Suir, where sandstones and slates prevail, goitre and cretinism are almost unknown, while on the Kilkenny side, where limestones abound, goitre is not uncommon. Perhaps the idiotic behaviour of those famous Kilkenny cats is attributable to the calcareous impurities of the water with which these unfortunate quadrupeds slaked their thirst.

EFFECT OF ANIMAL EXCRETA.

The products of the decomposition of animal matter in water is, however, the most objectionable impurity. Organic matters, produced by the decomposition of vegetable substances, are not especially dangerous, but the products of decomposing animal substances are highly dangerous, even when in minute quantities. These impurities do not make themselves apparent to the taste. On the contrary, such waters are frequently considered unusually fine in flavor, and persons go a great distance to procure them. Nevertheless, they contain an active poison. Many diseases of the most fatal character are now traced to the use of water poisoned with the soakage from soils charged with sewage and excremental matters. Sudden outbreaks of disease of a dysenteric character, are often caused by an irruption of sewage into wells, either from a break in the sewer or cess-pool, or from some peculiarity of the season. Such contamination of the water is not indicated by any perceptible change in the appearance of the water. The filtered sewage, clear and transparent, carries with it the germs of the disease. At a convent in Munich, 31 out of 121 of the inmates were affected with typhoid fever. It was found upon investigation that the well was polluted by sewage, and the disease disappeared as soon as the proper repairs were made.

At Pittsfield, Mass., the typhoid fever suddenly broke out in a large boarding-school for young ladies. The water was found to be contaminated with sewage owing to a leak in the cess-pool.

At Edgewater, on Staten Island, in 1866, the inmates of a small block of houses were afflicted with typhoid fever, several deaths occurring. On making investigation, the health officers found that a neighbor, through whose land the underground drain passed, had taken the liberty of closing up the drain, thus sending its contents back upon this block of houses, contaminating the well, and thus actually murdering the unfortunate victims with sewer poison.

Dr. Stephen Smith, one of the health commissioners of this city, describes an interesting case that came to his knowledge. He visited an old school-mate, a clergyman, in the country, and in the course of conversation his friend told him of a family in which typhoid fever had made its appearance, five members having already died, while another was then fatally sick. The physician called the attention of his friend to the fact that typhoid fever is now attributed to the poisoning of the water by animal refuse. This was new to his friend, the clergyman, who had not thought of attributing it to anything else than to the visitation of Providence. They went together to visit the locality, and found the house situated on an elevation, with all its surroundings admirably arranged for health. One readily believed the statement that there had not been a case of sickness in the house for twelve years. A few weeks before the fever appeared, when the laborers on the farm were busy taking in the crops, one of the valves of the pump got out of order. Being unable to get their usual supply of water, and being too busy to send for the pump-maker, they sent a man down to a neighboring spring to draw water, who finding that it was not easy to dip the water of the spring, from the shallowness of the pool, drew his supply from a brook near by. From this source the family was supplied for two or three weeks. This stream, higher up, ran through several farm-yards and received the surface drainage. The first symptoms of poison by this water were a slight nausea and mild diarrhœa; after several days typhoid fever in its worst form was ushered in. Of the entire family but two escaped an attack, and they did not use the water.

It is a common saying in villages and towns that "There was health in the old houses, while there is death in the new." This is owing to the fact that when villages were first settled, the houses were supplied with water from the springs on the hill side, while, as the dwellings multiplied in number, these sources of supply proving insufficient or too distant, wells were sunk in the valley, which, of course, received the drainage of the locality. Hence diseases, such as typhoid and typhus fevers, diphtheria, etc., which were unknown to the early settlers, ultimately became prevalent.

I might multiply illustrations without end, of cases in which diseases have been directly traced to impure water. I have here a little diagram which illustrates a case that occurred in the town of Charmouth, in England, a little village situated on the side hill, at the mouth of the Char. The houses are supplied from surface wells, sunk in the gravel and marl.

Typhoid fever broke out. My friend, from whom I obtained the facts, was a scientific man, and knowing that it was not safe to drink the water from these wells, so informed his friends, whom he directed to draw their supplies from the spring above the village. My friend had half a dozen children. Two or three of them were strong enough to manage the pump, and against his express order they drew the water from the well and drank it. They got the disease as a consequence; but none of the children who could not use the pump, and none of the neighbors, who drew water from the springs, were affected.

This city, during the last century, and before the introduction of sewers or the Croton water, was ravaged every few years by deadly epidemics, which are now believed to have been favored and invited by the defilement of the wells then in use, by sewage and fæcal soakage. No such visitation has occurred since the introduction of the Croton water, and the completion of the very perfect system of sewers.

Cholera, though it does not originate from polluted water, is disseminated chiefly by the aid of wells, and other impure water supplies.

At Exeter, England, in 1832, 1000 deaths occurred from cholera. A purer supply of water was then introduced from a locality two miles higher up the river, above the point at which it received the sewage of the town. When the cholera again invaded the city in 1849, only forty-four cases occurred, and in the cholera season of 1854, there was hardly a case.

In London, in 1854, the water supplied by the Southwark Company contained much sewage, while that applied by the Lambeth Company was very pure. Both companies had pipes in the same streets, supplying water indiscriminately on both sides. Among those who used the Southwark water the deaths amounted to 130 in 10,000, while among those who drank the Lambeth water, they amounted to only thirty-seven in 10,000; 2,500 persons were destroyed by the Southwark water in one season. On the previous visitation of 1848-49, the case was the reverse. The deaths from the Lambeth amounted to 125, while those from the Southwark amounted to 118 in 10,000. At that time the Lambeth company took their water from a point lower down the river.

Another very striking instance occurred in London. The famous Broad street pump supplied water in one of the most fashionable localities of the West end. During the visitation of 1848-49, this pump killed 500 persons in a single week, by disseminating cholera. The wealthy people of the West end went to Brompton, a fashionable summer resort, about five miles up the Thames, and soon the cholera broke out among them there. The health officers soon discovered, on investigation, that these people had been in the habit of sending to the Broad street pump for tea-water, and had brought the cholera with it. A curious case was that of an old spinster, who had moved to Hampstead, three miles from the pump, but who sent her maid daily, for a kettle of the highly-prized tea-water. She and her maid were the only persons who suffered from cholera at Hampstead.

A similar story might be told of an outbreak of cholera in a shanty village, west of Central Park, and another in a shanty village on the heights across the river. In both cases, it was clearly shown that the cholera germs were distribnted among the unfortunate squatters by the waters of the single well in each village. There is a famous pump in the twelfth ward of Brooklyn, at the corner of Van Brunt street, from which over fifty families obtained their water supply. In 1866 cholera broke out in five or six of these families, but the spread of the disease was prevented by the prompt action of the health officer, who removed the pump handle.

From these facts, it is seen that water aids in disseminating two of the most fatal diseases which affect the human race; the typhoid fever and the deadly cholera. During the ten years from 1856 to 1866, there were 21,000 deaths from cholera in England and Wales, and 150,000 deaths from typhoid fever. There is every reason to believe, that at least three-fourths of these deaths might have been prevented had proper attention been paid to the purity of the water supply. This poisoning by bad water is now fully established, and must awaken communities to the vital importance of securing a pure and unfailing supply of this indispensable beverage. Shakespeare describes blood poisoning as graphically as if he were describing the effects of bad water, when he says:

> "Whose effect
> Holds such an enmity with the blood of man
> That, swift as quicksilver, it courses through
> The natural gates and alleys of the body,
> And with a sudden vigor it doth posset,
> And curd, like eager droppings into milk
> The thin and wholesome blood."

Besides the diseases which I have mentioned, it may be considered as fully established that the ova of entozoa (the eggs or embryos of parasitic worms) gain entrance to the body in the water we drink. We have no reason to believe, however, that the animalculæ to which I have already called your attention, as existing in the Croton and Ridgewood waters, and which you saw in all their activity projected on the screen, by the compound microscope, are such embryos; or, in fact, that they are in any way objectionable

In Ireland, however, it is stated that one-sixth of the deaths are caused by hydatids in the liver. These are the larval forms of the tænia or tapeworm of the dog. Young leeches, contained in drinking water, sometimes fix themselves on the pharynx. In a march of the French in Algiers, 400 men were in the hospital at one time from this cause.

[To be continued.]

Improvement in Motive-power Engines.

The 136th meeting of the Society of Art, at the Massachusetts Institute of Technology, was held on Dec. 28.

Mr. J. A. H. Ellis gave a description of his process of using the heat in exhaust steam to produce power. By this process the same fuel now required to produce one hundred horse-power with an ordinary steam engine is made to produce two hundred and fifty horse-power, making a gain of one hundred and fifty per cent. in the amount of power obtained by the consumption of a pound of coal.

To accomplish this result two engines are used; they may be coupled together, or used independently, as desired. One of these engines is run by steam in the usual way, and its exhaust taken to heat the boiler that drives the other engine; this boiler is filled with a mixed volatile liquid, consisting principally of the bisulphide of carbon, which boils at one hundred and ten degrees Fahr., and at the temperature of exhaust steam gives a pressure of sixty-five pounds to the inch. This boiler is heated by passing the exhaust steam through its flues on its way from the cylinder to the atmosphere, and the vapor which is produced in it is used to drive the second engine; the exhaust vapor from this engine is condensed to liquid by cooling, and pumped into the boiler again, and used continuously, with very little loss.

Mr. Ellis has two engines arranged on this plan now running at the Atlantic Works in East Boston. Indicator-diagrams taken from these engines while doing their regular work show that, while the steam engine was producing 11 2-10 horse-power, the vapor engine, driven entirely by the heat of its exhaust, was producing 18 8-10 horse-power, and that the two together were giving 30 1-10 horse-power from the same fire previously reqnired to produce 11 3-10 horse-power with the steam-engine alone—showing a gain of one hundred and sixty six per cent. in the amount of power obtained from the fuel by this process.

In cases where two mills using steam power are situated near each other, the exhaust from one of them can be taken to heat the boilers of the other, and no fuel, fireman, or chimney will be required; its engine

will run continuously without attention as long as the exhaust steam to heat its boilers is received; and the power obtained will be fifty per cent. greater than that of the steam-engine from which the exhaust is received.

There will be no danger of an explosion of the vapor boiler, as the heat of the exhaust steam will not carry the pressure above 70 pounds under any circumstances, and if all the liquid in it should be evaporated out, no injury would be done, as it would not be overheated or burned by the heat of the exhaust steam passing through it.

For steamships the advantages of this arrangement are still greater than for stationary engines, as only two-fifths of the coal now required to make a voyage would be needed; the space now occupied by this extra fuel could be used for additional freight; the boilers would also occupy much less room in the ship than is now required for the steam-boilers, and as no fire is used for the vapor-boilers, they can be placed in any part of the ship where space is of the least value.

The liquid used in these vapor-boilers costs one dollar per gallon, and the loss of it amounts to about one gallon per day for each forty horse-power produced, making the cost of the additional power obtained by this process two and one-half cents per day for each horse-power, or less than one-tenth the cost of steam-power.—*Boston Transcript.*

[We clip likewise the following on the same highly interesting subject; taking the opportunity to say that, *practical difficulties* apart, *we* have not been among those who have disparaged the cultivation of this field of experiment. Even the old ammonia engine project, of this class, we believe has met with unmerited neglect.—Ed.]

REDUCTION IN THE COST OF STEAM POWER.

Messrs. Editors: I am running a twenty-horse engine constantly with the heat obtained from the exhaust steam of another twenty horse engine, thereby doubling the amount of power previously produced by the consumption of a pound of coal. This can be done with any engine in use. The apparatus used for the engine that I am running consists of a tubular boiler, twenty-six inches in diameter and ten feet long, with sixty 1¾-inch iron tubes in it. This boiler is placed in an upright position and filled half full with the bisulphide of carbon, and is heated by passing the exhaust steam through the tubes. It enters the top of the boiler and passes out at the bottom; the steam is completely condensed in passing through; and the temperature of the water of condensation discharged at the bottom of the boiler does not exceed 120 deg. Fahr. at any time. The latent heat of the steam is absorbed by the bisulphide of carbon, which is converted into vapor very rapidly under a pressure of 50 pounds to the inch. This vapor I use to drive my second engine, and find the supply ample to do as much work as the engine whose exhaust is used is doing. The exhaust from the engine using the bisulphide vapor is condensed by passing through a coil of iron pipe immersed in water, and is pumped back into the bottom of the boiler as fast as condensed, and used continuously, the waste not exceeding half a gallon per day. Only forty gallons are required to work the engine successfully. JOEL A. H. ELLIS.

No. 100 Summer street, Boston, Mass.

—*Am. Artisan, Oct.* 11, 1871.

King Stork's "Bill" Introduced Among the Frogs—King Log to Retire for a Short Space.

[SPECIAL EDITORIAL NOTE.—Since the following was put into type, a gentleman who is fully acquainted with Mr. Whitbeck's *personal* views upon this subject of Gas Legislation, has favored us with a call, and has been kind enough to hand us, at our request, the following statement, the authenticity of which may be implicitly allowed.—Ed.]

Mr. Editor: Mr. Whitbeck, on behalf of some of his constituents, introduced the following bill, which, however, we are informed, does not meet his approval, as he does not consider that the penalty clause especially, is just and fair either to the public or to the producers of gas. * *

[From the *New York Herald* of February 18th.]

Among the bills introduced to day was one which, if carried out, may produce a reform in the gas supply in the city of New York. Year after year bills are introduced looking to a remedy for the crying evil of the tyranny of the gas monopolies in New York and elsewhere; but by some subtle "influence" the bills are killed. The bill introduced to-day by Mr. Whitbeck will, no doubt, cause the gas men to hurry hither to defeat its passage. Mr. Whitbeck being a large property owner in the city, is in earnest in this matter; but, as many of the members of the present "reform" Legislature are not imbued with as much earnestness as he is, he may find it very difficult to get his bill through. The bill speaks for itself, and is as follows:

An Act to provide for a pure quality and a just measure of gas in the city of New York.

The people of the State of New York, represented in Senate and Assembly, do enact as follows:

Section 1. John W. Draper, of the University of the city of New York; Frederick A. J. Barnard, of Columbia College, and R. Ogden Doremus, of the College of the city of New York, are hereby appointed Commissioners for the inspection of gas in the city of New York. It shall be their duty to establish a standard for the illuminating power of the gas supplied by the several gas companies in said city; to establish one or more stations in each of the districts supplied with gas by the several gas companies in said city, for the measurement of the gas supplied by each company to the consumers; to keep an accurate record of the illuminating power of the gas supplied by each company, and on Monday of each week to publish in one or more of the daily newspapers of said city a certificate of the results of such measurement, and the percentage by which the gas supplied by each company is less than the standard of illuminating power, if such be the case. It shall also be their duty to establish a standard and regulations for testing the meters supplied by said gas companies to their consumers, or which may be used to determine the quantity of gas supplied to each consumer.

Sec. 2. Whenever any charge is made by any gas company in said city against any person for gas supplied to be consumed by him, such person shall deduct from the sum so charged the percentage, if any, by which the gas so supplied shall fall short of the standard as determined by the Commissioners aforesaid. If the charge be made for a period less than one week or that includes but one Monday, he shall deduct the percentage certified for the Monday included in the period, or if a Monday be not so included, for the Monday next preceding. If the charge be made for a period which includes more than one Monday, he shall deduct the average of the percentage certified for the Monday included in the period charged for. No company shall charge or collect for gas in advance, and if any company neglect or refuse to allow and deduct the percentage aforesaid they shall be liable to the person who pays them for the same and for $25 penalty in each case in addition, to be set off against any subsequent charge for gas supplied by the same company to the same person, or to be recovered by him in an action against the company.

Sec. 3. Any gas consumer may have the meter through which his gas flows tested by the said Commissioners on payment of $1 therefor. In case the meter measures more gas than actually passes through it when tested by the standard established by the said Commissioners, they shall certify to him the percentage of such excess, and the said consumer shall be entitled upon such certificate to recover from the company who supplied the gas the same percentage of the amount he may have paid them during the three months preceding the date of the certificate, for gas supplied through that meter or to set off the amount of the percentage against any charge for gas supplied to him by the same company.

Sec. 4. The salaries and expenses of the Commissioners shall be borne by gas companies in the city of New York in equal proportion. Each of the Commissioners shall receive a salary of $1,000 per annum, and their actual reasonable and necessary expenses shall be audited by the Comptroller of the city of New York, and both salaries and expenses paid by him to the Commissioners. He shall apportion the amount so audited and paid by him among the several gas companies in the city of New York, and shall collect the same of them, and his certificate of such audit and payment shall be conclusive evidence against the said companies.

Sec. 5. This act shall take effect immediately.

Progress of the Artesian Well in Boston.

[The item below has been for some time in type, and the figures given are doubtless antiquated, though still of interest.—Ed.]

The work of boring the well was begun in the latter part of the month of March 1871, and has been going steadily forward up to the present time, the progress made being from one to fifteen feet each day, at a cost of $15 per foot, and as the well has already reached the depth of 1000 feet, of course the cost already foots up $15,000, and how much more it will take is a matter of uncertainty; but even should it cost $20,000, the company would save the amount in three years, and have their future supply at a merely nominal price.

In boring the well the drill has passed through a variety of strata, which would be of interest to the geologist—black shale, slate, quartz, white quartz, intermixed with shining and glistening ores, and a sort of honeycombed rock, indicating the action of the tides or water. Yesterday the drill was passed through a black shale stone, and this morning it struck a dark blue stone nearly as hard as adamant.

At the depth of eighty feet they struck a ledge, and they are still at work in it, occasionally finding a thin stratum of clay. At this depth they also found water, which furnished a supply of about fifty hogsheads an hour, and pumping it out at that rate for fifteen minutes, only lowered it six inches in the five-inch bore. Not being satisfied that this would give them water enough for their works, they still kept on through the ledge to the depth of 140 feet, or 210 feet from the surface, when they again reached water in the midst of the ledge, which now rises to within eight feet of the surface.

The well is now over 1,000 feet in depth, 900 feet of which are through solid ledge, varying of course in hardness according to the strata, but never softer than an occasional layer of slate and honeycomb stone. When the work was first commenced, a drill would last thirty-six hours without sharpening; now the same kind of a drill will only last one hour.

The diameter of the bore is five inch; the drill is four inches across. The drill and iron shafting which connects it weigh now 1,200 lbs., and the rope by which it is lowered weighs 900 lbs. The machinery used for driving the drill is similar to that used in the oil regions of Pennsylvania.

The power is furnished by a 16-inch horse power engine, with a walking-beam of 36 inches stroke, at the rate of about thirty strokes per minute. It is the intention of the company to keep the drill at work until they obtain a sufficient volume of water for their use, unless their money gives out, or the drill goes through on the other side.—*Amer. Railway Times.*

Cost of Lighting the City.

MR. VAN NORT'S POLITE NOTE TO THE GAS MONOPOLISTS.

Mr. George W. Van Nort, the Commissioner of Public Works, has addressed the following letter to each of the several gas-light companies of the city, viz., Manhattan, Metropolitan, New York, and Harlem:

DEPARTMENT OF PUBLIC WORKS,
COMMISSIONER'S OFFICE, 237 BROADWAY.
NEW YORK, February 24, 1871.

Sir: The city is at present paying to the various gas companies for gas furnished to the corporation different prices per annum for each light. The amount charged by all the companies is deemed by this department to be unreasonable and exceeding the amount that should be charged by any one of them. It is the desire of this department to co-operate with the other branches of the city government in the reduction of the expenditures of the city so far as possible, where the same can be done without detriment to the public service; and in order that this desirable result should be attained it is deemed necessary that the cost of lighting the public lamps should be reduced as far as practicable. It would also seem just that this action should be taken in view of the fact that the same prices are now charged as when coal under the war inflation was 100 per cent. more than at present, and other material needed for the manufacture of gas could be had only at a largely increased cost. The prices charged the public are the same as paid by the private consumers, notwithstanding the valuable franchises and privileges enjoyed by the companies in the laying of mains through the streets, for which no equivalent is given the city. I earnestly trust your company will take these matters under serious consideration, and that you will meet me in consultation at an early hour.

Trusting to hear from you, I remain, yours respectfully,

GEO. M. VAN NORT,
Commissioner of Public Works.

TO REMOVE THE DEPOSIT OF CARBON FROM CLAY RETORTS.—Take out the stopper from stand pipe, so as to allow a current of air to pass through the retort and oxidize the carbon. Use no bar. Put in a charge of coal after the retort has lain idle the number of hours required, and when it is withdrawn the carbon comes with it.

PETROLEUM PAINT OIL.—A paint oil is being made from petroleum, which, it is claimed, is equal in all respects to linseed oil, and can be sold at about half the price.

[Desirable, but doubtful.—Ed.]

Correspondence.

[Correspondents, in all cases, should sign their communications with their names and address in full—not necessarily for publication, but as a guarantee of good faith.—Ed.

A Correction.

Knoxville, Tenn., Feb. 20, 1872.

Mr. Editor: In the last issue of your Journal I notice a communication from Mr. Collier, in which he says: "On page 21 I find a report of the explosion at the Metropolitan Gas Works, and one at Knoxville, Tenn." This is incorrect. If he will look carefully at page 21 he will, as regards Knoxville, Tenn., find no such report, nor has there been any explosion here. Kindly insert this correction and oblige

Yours respectfully,
Jas. Somerville, Supt.

On The Gases "Occluded" in Coal.

By Dr. E. Meyer.

I desire this paper to be considered only as a preliminary notice, it being my intention to extend these researches. Since, so far as I am acquainted, the question whether any at all, and, if so, what kind of gases are occluded in coal, has not been experimentally dealt with, it occurred to me to test Zwickau coals (Saxony) in this respect.

Lumps of hard and compact coal the size of a walnut were put into a flask, previously partly filled with thoroughly well-boiled and hot distilled water, the flask was next closed with a perforated caoutchouc stopper wherein a glass tube was fitted, which, serving as gas-conveying tube, was carried into a vessel filled with water deprived of air. The apparatus thus arranged was kept at boiling heat for some time in order thereby to eliminate the film of air which mechanically adheres to the coal. The boiling was further continued after the gas conducting tube had been placed over a graduated glass tube, previously filled with distilled water freed from air and placed on a pneumatic trough. The gas thus collected (constantly evolved from the lumps of coal) was analysed according to Bunsen's method, and found to consist in the first sample operated upon, centesimally, of: Carbonic acid, 16·6; marsh gas, 20·4; nitrogen, 53·3; oxygen, 1·7; heavy carburetted hydrogen absorbable by fuming sulphuric acid 7·7. Second sample—Carbonic acid, 22·4; marsh-gas, 22·3; nitrogen, 48·0; oxygen, 4·1; heavy carburetted hydrogens absorbable by fuming sulphuric acid. The large quantity of nitrogen and the small quantity of oxygen deserve special notice. The samples of coal experimented with had been kept in a cellar for a period of several months in contact with air, so that it would appear that the oxygen of the air absorbed has served for the oxidation of the coal and formation of carbonic acid.

I must also not neglect to call attention to the heavy carburetted hydrogens which, as far as I am aware, have not been hitherto noticed as being occluded in coal. It might be surmised, yet it is very improbable, that these heavy carburetted hydrogens have been formed by the heating of the coal under water at 100°. I intend to elucidate this point by exhausting the gases from coal with the aid of a mercurial air-pump at the ordinary temperature of the air, in order to ascertain whether the same kind of coal will then also yield carburetted hydrogens absorbable by fuming sulphuric acid. These researches will be continued and extended to other kinds of coal. The results of my experiments I shall publish at a future date.—*Journal für praktische Chemie.*

The Coal Beds of Illinois.

The great State of Illinois, so rich in the fertility of her prairies, is scarcely less favored in the immense beds of coal that underlie them. The peculiar feature that has distinguished the Prairie from her sister States, the absence of the fuel which their natural forests supplied, would seem to have been foreseen and provided for when these vast deposits were stored away in the dim ages of the Carboniferous period, for it is claimed that in no other portion of the country can coal be so easily obtained with a moderate investment of capital as in Illinois. Coal is not only embodied heat, but undeveloped force. Inasmuch as steam stands alone as the motive power in use in manufacturing and commercial enterprise, and as coal furnishes the cheapest means of generating steam, it follows that the State in which this fuel is the most accessible, in the hands of an enterprising population, must soon and surely take the pre-eminence in manufactures and trade.

The development in Illinois of this element of her wealth is rapid. Already she is exporting large quantities of coal to neighboring sections, to which her admirable system of railroad and water communications gives cheap and ready access. Especially is this the case in that rich coal-bearing part of the State which lies in close proximity to and between the important cities of Rock Island and Peoria. This section, in which largely-productive coal mines have been opened, although thickly settled, fertile, and possessing a large and growing manufacturing interest, has been till quite recently comparatively insulated; but is now brought into direct communication with the great business centres of the country by the completion of the Peoria and Rock Island Railway. This much-needed road has especial facilities for distributing the immense stores of coal that underlie its beds, as well as the other produce of the region, as it connects the navigable waters of the Illinois and Mississippi, and forms a junction at each end with roads that branch off in all directions. It also forms, with the Indianapolis, Bloomington and Western, and the Davenport and St. Paul's, the construction of which goes on rapidly, a trunk line of 575 miles from Indianapolis to St. Paul's, and by its junction at Rock Island with the Chicago, Rock Island and Pacific Railroad, connects at Omaha with the Union Pacific. The spirit of enterprise that is thus developing the various resources of this State deserves and must surely command success.—*Evening Post.*

Gas Pipes and Lightning.

At a meeting of the Manchester Literary and Philosophical Society, Jan. 9, 1872, Henry Wilde read an account of the striking of a church by lightning, which we condense:

The church at Crumpsall is about a mile distant from that at Kersal Moor, and the ignition of gas by lightning, which undoubtedly caused its destruction, is not so distinctly traceable as it is in other cases which have come under my observation, because the evidences of the passage of the electric discharge have been obliterated by the fire. From information, however, communicated to me by the clerk in charge of the building, as to the arrangement of the gas pipes, the most probable course of the electric discharge was ultimately found.

The church is provided with a copper lightning conductor, which descends outside the spire and tower as far as the level of the roof. The conductor then enters a large iron down-spout, and from thence is carried into the same drain as that in which the spout discharges itself. Immediately under the roof of the nave, and against the wall, a line of iron gas pipes extended parallel with the horizontal lead gutter which conveyed the water from the roof to the iron spout in which the conductor was enclosed. This line of gas-piping, though not in use for some time previous to the fire, was in contact with the pipes connected with the meter in the vestry, where the fire originated, and was not more than three feet distant from the lead gutter on the roof. As no indications of the electric discharge having taken place through the masonry were found, as in the case of the church at Kersal Moor, it seems highly probable that the lightning left the conductor at the point where the latter entered the iron spout, and by traversing the space between the leaden gutter and the line of gas-piping in the roof, found a more easy path to the earth by the gas mains than was provided for it in the drain.

In my experiments on the electrical condition of the terrestrial globe (*Philosophical Magazine*, Aug. 1868) I have already directed attention to the powerful influence which lines of metal, extended in contact with moist ground, exercise in promoting the discharge of electric currents of comparatively low tension into the earth's substance, and also that the amount of the discharge from an electro-motor into the earth increases conjointly with the tension of the current and the length of the conductor extended in contact with the earth. It is not, therefore, surprising that atmospheric electricity, of a tension sufficient to strike through a stratum of air several hundred yards thick should find an easier path to the earth by leaping from a lightning conductor through a few feet of air or stone to a great system of gas and water mains, extending in large towns for miles, than by the short line of metal extended in the ground which forms the usual termination of a lightning conductor.

It deserves to be noticed that in the cases of lightning discharge which I have cited, the lightning conductors acted efficiently in protecting the buildings from damage of a mechanical nature—the trifling injury to the church tower at Kersal Moor being directly attributable to the presence of the gas pipes in proximity to the conductor. Nor would there have been any danger from fire by the ignition of the gas if all the pipes used in the interior of the buildings had been made of iron or brass instead of lead: for all the cases of the ignition of gas by lightning, which have come under my observation, have been brought about by the fusion of lead pipes to the line of discharge. The substitution of brass and iron, wherever lead is used in the construction of gas apparatus, would, however, be attended with great inconvenience and expense, and moreover, would not avert other dangers incident to the disruptive discharge from the conductor to the gas and water pipes within a building. I have therefore recommended that in all cases where lightning conductors are attached to buildings, fitted up with gas and water pipes, the lower extremity of the lightning conductor should be bound in good metallic contact with one or other of such pipes outside the building. By attending to this precaution the disruptive discharge between the lightning conductor and the gas and water pipe is prevented, and the fusible metal pipes in the interior of the building are placed out of the influence of the lightning discharge.

Objections have been raised by some corporations to the establishment of metallic connection between lightning conductors and gas mains, on the ground that damage might arise from ignition and explosion. These objections are most irrational, as gas will not explode unless mixed with atmospheric air, and the passage of lightning along continuous metallic conductors will not ignite gas even when mixed with air. Moreover, in every case of the ignition of gas by lightning, the discharge is actually transmitted along the mains, such objections notwithstanding. A grave responsibility therefore rests upon those, who, after introducing a source of danger into a building, raise obstacles to the adoption of measures for averting this danger.

The "National Coal Gas" Works.—The *Newburgh Journal*, speaking of the operations of the Gas-Light Company of that city, which is using the process of the "National Coal Gas Company," says:

"We are told that the Newburgh Gas-Light Company has, within five months, saved a million feet of gas. It has done this by the new method which was such an annoyance to consumers when first introduced. The saving is so great the managers think they can reduce the price of gas to two dollars and a half a thousand. If our information is correct the "good time coming" cannot come too soon.

This is highly encouraging information to those who have adhered to the fluctuating fortunes of the "National" process, the prominent features of which have heretofore been elaborated in the columns of this Journal.

Association of Gas Engineers.—The first annual meeting of the New England Association of Gas Engineers was held by adjournment at the rooms of the Board of Trade, Boston, Mass., Wednesday, February 21st, and the following officers were re-elected:

President—W. W. Greenough.
Vice-Presidents—George Dwight, William York.
Directors—John H. Hill, James H. Armington, O. E. Cushing, George D. Cabot and David Moore.
Secretary and Treasurer—George B. Neal.

An important paper on the subject of supplies and piping of buildings was presented by J. H. Armington, of Providence, Dwight, of Springfield, and Cushing, of Lowell, and ordered printed for distribution, and will be discussed at the next meeting. Several important matters were presented for consideration. Voted to adjourn to Newport, Wednesday, August 14, 1872, and voluntary papers are requested on any subject of interest.

Ingenious Contrivance.—A contrivance has been placed in engine-house No. 7, Jersey City, by which the hammer attached to the bell, on first rising to strike the alarm of fire, unfastens the horses in all the stalls, and turns on the gas throughout the building. The horses have been trained so that upon the unloosening of their halters they immediately leave their stalls and take their position at the engine.

Gas from Gasoline.—In response to a communication relative to assessing the tax upon gas produced from gasoline by the "solar gas generation," the Commissioner of Internal Revenue states that inasmuch as some doubt exists as to whether gas produced from gasoline by the various machines now in use is a manufacture, assessors have been instructed not to assess the tax on gas when so produced by private individuals for their own use.

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CHARLES FABEN, Superintendent and Engineer Toledo Gas-Light Co., Toledo, O.
PETER F. BURTIS, Supt. and Engineer, Chicago Gas-Light Co., Chicago, Ill.
JAMES R. SMEDBERG, Consulting Engineer, San Francisco Gas-Light Co., Cal. [254-

THE FILTRATION OF OILS.—Mr. H. Stopfer, of Manchester, and Mr. F. Dean, of Leeds, have patented an invention in England for the "filtration" or separation of oil. This invention relates more particularly to the treatment of oil, or of oleaginous or fatty matter or compounds, such as, for example, the matter styled "foots," in order to separate the clear or fluid oil therefrom. In the first place, the said oil or matter is subjected to a preparatory filtration, in order to remove the grosser impurities, a vacuum being formed under the filtering medium by pumping out the filtered oil or matter. The said oil, or matter, is then forced at a great pressure into an apparatus containing one or more filters of slate, stone, or other porous substance, or combination of substances or materials, the fluid oil being forced through the said filter or filters. The invention is also applicable to the purification of beeswax. The filtering apparatus is sometimes heated.

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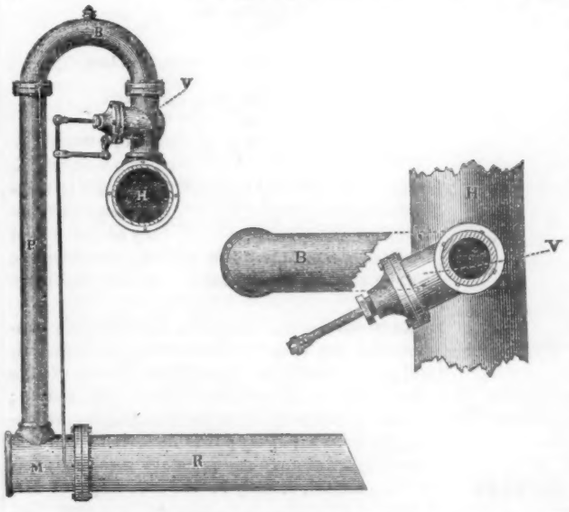

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☞ All communications to be addressed to "THE EDITOR, No. 42 Pine Street, Room 18, New York.

SATURDAY, MARCH 2, 1872.

WISHING TO MAKE THIS JOURNAL an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit letters from all among them who make the study of these subjects a pleasure, or a profession.

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THE GAS WAR.

In late articles, we have expressed the apprehension that the "pow-wow" that preceded the holidays, about some sort of gas-legislation, during the current session, might, after all, "go down like a busted balloon." During the last fortnight, however, divers straws have indicated to us that the wind still blows the same way. Such items as the following have in fact been so plentiful that we got tired of them, and have only preserved two; tu whit (as one of our "American humorists" would put it):

A CORPORATION GAS COMPANY.

Mr. T. Campbell introduced a bill authorizing the Mayor, Aldermen and Commonalty of New York to go into the business of *manufacturing and supplying gas for the people* of that City.

A bill will be introduced in the Legislature this week by Mr. Whitbeck to regulate the price and illuminating power of the gas supplied in this city. The bill provides that the price charged shall not exceed $2 25 per 1000 feet, and that the illuminating power shall be equal to that of sixteen sperm candles. The bill originated, we understand, with the hotel-keepers, who are determined to break down the monopoly so long enjoyed by the gas companies.

Words of ours cannot add strength, wisdom or beauty to the *first* one of our excisions above. Painfully realizing our lack of the genius needed to do justice to the subject; we might still do something, by quoting judiciously from the *Bigpo Papers*, as thus:

"I firmly du believe
In humbug generally,
Fer it's a thing thet I perceive
Tu hev a solid vally;
This hath my faithful shepherd ben,
In pastures sweet hath led me,
An' this 'll keep the people green
Tu feed ez they hev fed me."

But we refrain. Were we inclined, however, to depart from the serious and solemn vein which befits a subject of such gravity, we might indulge in the suggestion that the "Aldermen and Commonalty" might claim that they at least had studiously cultivated the art expressed in the phrase we have underscored. But we again refrain.

As to our second quotation, it fortunately happens that our scissors subsequently encountered, and have transferred to another column of this issue, what we suppose to be the *bill* referred to; which, while apologizing in advance, and arrogating the most intensely polite intentions, and disclaiming sedulously any personal meaning; following, indeed, exactly in the foot-steps of Mr. Chucks the boatswain; claiming, however, that we feel and speak for the Gas Fraternity; we must be permitted to entitle as follows:

Articles of Incorporation of the METROPOLITAN MUTUAL-ADMIRATION GAS-OBSTRUCTION *and* GENERAL OBFUSCATION COMPANY.

The gentlemen who have thus strangely permitted their honored names to be paraded in a manner which irresistibly suggests the ordinary form of a bill for the incorporation of a Joint Stock Speculative Company, we are perfectly *sure* have not considered the full significance of their position, which is doubtless a passive one—we mean, not one of action. The most cursory and random examination of the "bill," to which they have (unwittingly, as we are confident) lent the high sanction of their names, makes it plain that no consideration of equity or justice towards *either the producer or consumer*, have governed the framing of the instrument. To our circle of readers, it would be superflnous, indeed almost an affront, to designate the points where we feel ourselves bound to take exception.

We have long since proclaimed *our* position on these questions. We are for neither King, Log, or Stork. What we favor, what we *demand*; is that representatives of the Gas Companies themselves shall be called into Council, in framing the law which is to govern the future of this great interest. *Let both sides be heard.* Let there be a law, but let that law be founded on fact, on science, and on justice; not on prejudice, on quackery, on popular error, on political favoritism, or (that we should have to say the odious word again!) on humbug. No law of this sort, will be passed at this session. There is not time; but we will throw out the idea, which we believe will meet with acceptation among the fraternity, that a commission be appointed by this Legislature, including the distinguished names of Draper and Barnard, *together with* some one or two eminent jurists, and one or two more, of men distinguished in, and identified with, the great Gas Monufacturing Interest, to report to the *next* session, a bill whose provisions would then be well-considered, just, and equitable.

[Since the above was written, as will be seen in another column, we have a disclaimer from Mr. Whitbeck of responsibility for the bill above discussed. It is stated that he intends to bring in another. Two other bills have in fact been introduced, but they must go over to our next.]

OXYHYDROGEN REDIVIVUS.

Optimists are apt to imagine, when reading of the amazing delusions of the past, that human credulity and gullibility are also things that belong to a departed age, and that in these later and wiser (?) times, we are prone to demand some knowledge of a subject before we pin our faith to it, and that we do not cast our bread upon the the waters, without some positive assurance that it will truly return to us after many days.

Fain would we fix ourselves in this fond faith, but Experience is too much for us, having sadly and painfully enforced a conviction of the reliability of two trite maxims, conceded by all, but practically acted on by few, that "Human Nature is always the same," and that "History repeats itself."

It will strike many, at first glance, as highly absurd, were we to maintain that if Mesmer could be resuscitated with *his* psychism, or, say Nicholas Flammelle and the lovely Perronelle, his wife, with their strange jargon of alchemy and devotion; hosts of the wisest of us would run after them like sheep; yet, think, nevertheless, that it has lately been asserted, by those who claim to know, that one-fourth of the people of these (highly educated) United States, are at this time, votaries of a delusion sustained by manifestations not a whit more respectable than those of the Cock Lane Ghost. These cogitations arose during the perusal of some paragraphs from various sources, tending to show that a renewed effort is on foot to carry *oxygen gas* through our streets and into our houses, with the idea that it will come into general use for illuminating purposes.

In one of our daily Journals, the one to which we readily concede its own claim to be considered now the *leading* Journal of the Metropolis, we have found the greater part of two editorial columns given to the advocacy of this scheme, which is described as "an illumination proceeding from a new material (!) called *oxhydrique gas*. It is a mixture of oxygen and hydrogen."

Let us still possess our souls in patience, and try to *argue* the point. Denunciation would doubtless but add to the flock which follow after the *new* light; *persecution* always has this effect.

Space will, at present, however, permit of but one argument; and this we shall put into the shape of a supposition, founded nevertheless, (on what might be) a fact.

The writer is now writing, at the silent hour of 4 A. M. (an hour he much affects), on a marble table, surrounded by a crowd of the comfortable things which accumulate in American homes. Looking around, it seems that these are almost all composed chiefly of carbon and hydrogen. In an adjoining apartment lie asleep the fellow-beings for whom he lives and strives. In a grate beside him burns a "sea-coal fire," such as Mrs. Quickly never saw; being, not to put too fine a point on it, a glorious blaze of Ohio Cannel, not yet so familiar to our citizens as it is bound to be. The *light* he writes by, while sitting under a handsome "gasalier," is unmitigated petroleum. This is for the sake of the eyes, of course. Around him is a confined space of the atmosphere, which keeps up that process of combustion, or destruction, that gives us our feeble and precarious tenure of life. Before the time of Father Adam, *his* Father had been conducting a chemical process in and on His laboratory, the Earth, which resulted in the establishment of the said atmosphere, exactly calculated, both quantatively and qualitatively, for the race of Adam. Would I have the proportion of oxygen in the atmosphere of this room either increase or diminish? Diminution everybody knows the effect of; who has been down in a diving bell, for example. In point of fact, everybody who has attended a course of chemical lectures should know the result of an increase.

Suppose that the pipes which drop through the ceiling over the writer's head, were filled with oxygen, under some pressure. Suppose (which is *quite* supposable) these pipes were not immaculate. It follows that this gas, which according to the *Times*, "is entirely clean and without smell" would add to the already normal proportion in the air of the room. Some strange phenomena would already have begun to manifest themselves. Instead of my petroleum alone burning, the lamp itself would take fire. The iron grate itself would be kindled by my cannel coal. Observing these things, I should, unless I had already myself caught fire, throw open the windows, to dilute the destructive element, seek for my fire-escape, and strive to save all the *lives* yet left.

Suppose, further, that the writer himself should venture to *sleep*, with such possibilities around him. But enough has been said. It seems to us that *gasoline* and *benzine* may "go under." Oxygen is doubtless a life-preserver, but it is none the less a deadly destroyer; and the proportion we already have about us, was established with a wisdom to which we can add nothing.

SENSATIONAL, BUT SENSIBLE.

A New York *Times*, of recent date, contains an article on "The Gas Question," which deserves the above epithets. We can give room to but one paragraph.

WHAT CAN BE DONE.

As to the possibility of improvement, the experience of other cities must be brought into consideration, in order to get at some information valuable to the public. Enterprise cannot be expected from the gas companies. They have the field all to themselves, and are impervious to assault, either from the individual consumer, or from a rival manufacturer. The city of London is served with gas by eighteen works. Of these, one contrives to give a light of one-thousand candle power from 1,500 cubic feet of gas, while others only give the same light power by three or four thousand cubic feet—the rates per foot to consumers being nearly equal But there are processes by which the results obtained may be indefinitely increased. The hydrocarbon process is said to give an addition of from twelve to a hundred per cent.. according to the material used. Another process, consisting of a new arrangement of the retorts so as to redistil the vapors now wasted, and which cause so much annoyance, gives a gain in the illuminating power of nearly 100 per cent. It is necessarily assumed that any improvement is compatible with health and public safety, but in any sense it shows that the crude, simple process in use by the first manufacturers of gas is worthy of investigation, and is susceptible of improvement were it only to the interest of the monopolists to encourage inventors.

DEATH OF COL. AMBROSE J. WHITE.—We regret to announce the death of Col. Ambrose J. White, who died at his residence in Brooklyn, on Sunday morning, the 26th inst., in the 59th year of his age. Mr. White for some time previous to his death, filled the position of Engineer of the Peoples Gas Works, Brooklyn, and was formerly Engineer of the Metropolitan Works in this City. We shall gather some facts for an obituary in our next.

LACLEDE GAS CO.—We understand that this company has secured the valuable services of Mr. William Farmer, to superintend the building of their works. He is now engaged in rebuilding the Cincinnati gas works, also extending those at Mobile. His capabilities as a gas engineer are well known, and we feel assured that he will give satisfaction.

RESIGNED.—We learn that Mr. James Thomson, engineer, who has been in the employ of the Pittsburgh Gas Company for a quarter of a century, has resigned.

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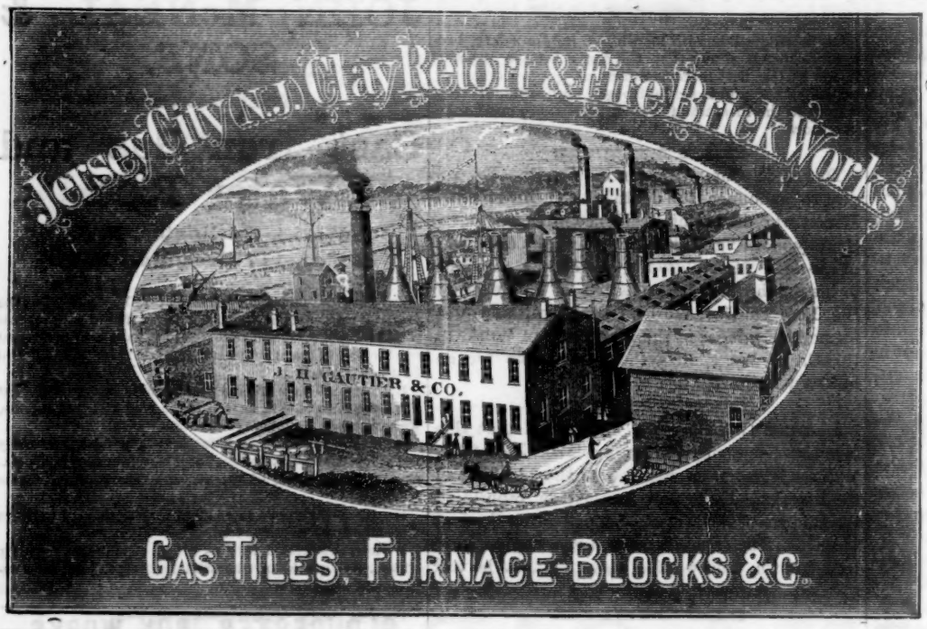

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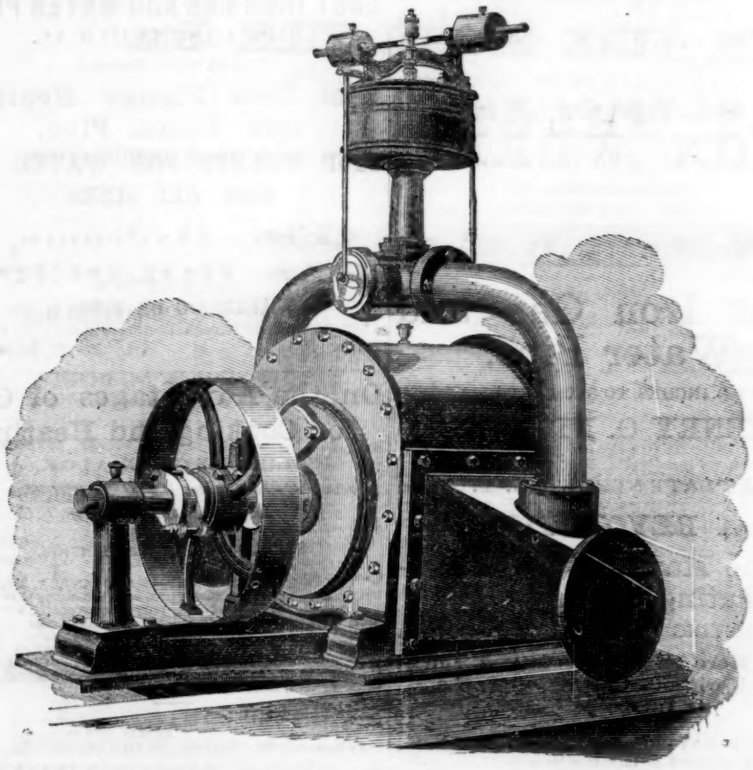

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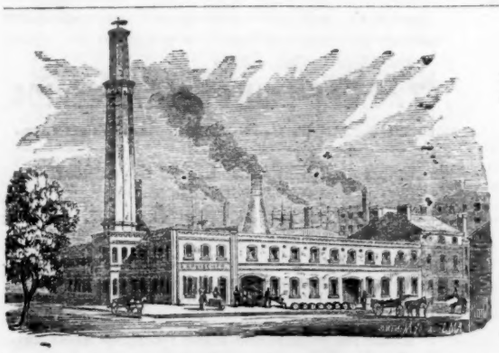

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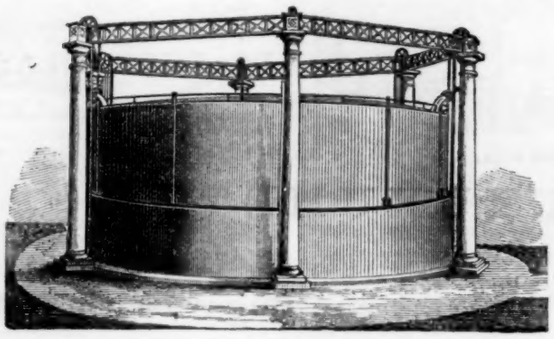

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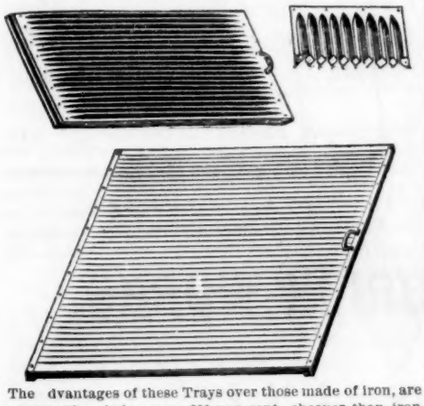

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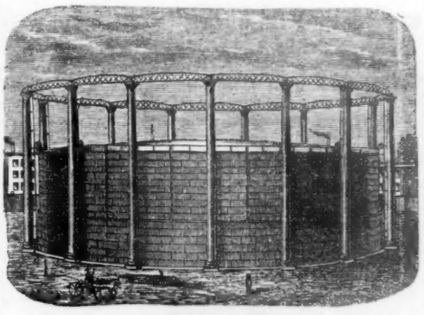

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We ask a trial, and allow them to stand upon their merits, which will prove them to be the most economical, considering their saving in expense, consequent upon their *reducing* the back pressure on the retorts, which in this respect *no other* Screen can begin to compare.

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American Gas Screen Manufacturing Co.,
257-tf HAVERHILL, MASS.

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Valve Manufacturing Co.

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Make Valves—Double and Single Gate—¾ inch to 36 inch, for Water, Gas and Steam.

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"I would say that if any certificate or affidavit is desired in relation to the superior character of the Ludlow Valve above others that I have seen, the same will be cheerfully given. I think, however, that the Valve proves for itself.

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"Superintendent Water Works.

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"I have to say that we find them always in order—operating easily under all degrees of pressure. In a words they have given perfect satisfaction in every particular.

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"We are now using and have been, since the commencement of our works, your valves, and they are proving entirely satisfactory.

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"Superintendent Water Works.'

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"With pleasure I can testify to their superiority. Their action has been perfect under all degrees of pressure, and have given perfect satisfaction.

"S. A. KINSEY, Ex. Sup't.
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"BROOKLYN GAS LIGHT COMPANY.

"I take great pleasure in saying that they give perfect satisfaction—opening easily and quickly, and requiring no effort to start them; even after they have been closed for months

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"OFFICE OF PHILADELPHIA GAS WORKS, 14th June, 1870.

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Curley's Improved Retort Setting and Independent Damper.

Prevents the sudden Chilling Contraction, and early Destruction of the Retorts; more than doubles their durability and maintains a high uniform heat.

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258-tf

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SAMUEL DOWN, President. HENRY CARTWRIGHT, Vice-President. THOMAS J. EARLE, Secretary.

Trustees:

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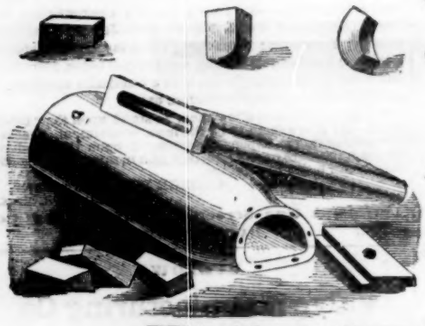

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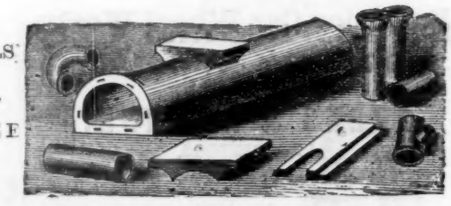

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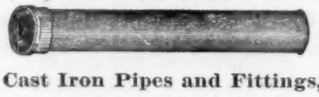

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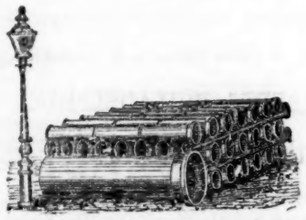

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Air and Immersed Tubular Condensers,

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Purifiers with Imp'd Dry Centre Valves,

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The designs for our apparatus are furnished by JAMES H. WALKER, Engineer and Superintendent Milwaukee Gas Works, who can be consulted on all matters relating to the working, erection of new, or extension of old works.

Parties employing us will find their orders promptly attended to, and satisfaction guaranteed in all cases.

The best references given on these points. 244-6m

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PLYMOUTH IRON WORKS,

CONSHOCKEN, PA.,

Manufacturers of

PIG IRON & CAST IRON GAS & WATER PIPES.

Also, Heay and Light Castings of every description.

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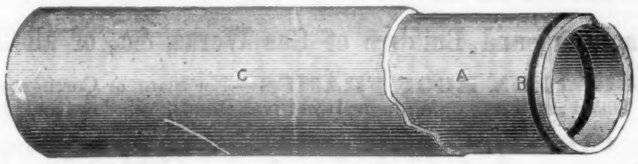

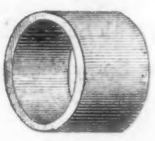

FIG. 2.

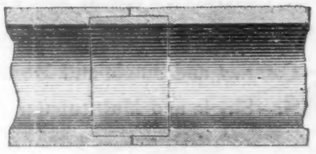

FIG. 3.

A—Cylinder of Wood. **B**—Band of Iron. **C**—Coating of Hydraulic or Asphaltum Cement.

FIG. 2.—Thimble for Connection. FIG. 3.—Horizontal Section and Connection.

Above is a cut of the

"WYCKOFF PATENT IMPERISHABLE GAS PIPE,"

manufactured by the NORTHWESTERN GAS AND WATER PIPE COMPANY.

This Pipe is made of White Pine, one inch to sixteen inches bore, in sections eight feet long, rounded in a lathe, coated inside and out with Asphaltum, connected with a tenon, or socket, and a thimble joint, perfectly air and water tight, being driven together with cement furnished by the Company. When laid its cost is about one half that of Iron Pipe, and is UNQUESTIONABLY the best Gas conducting Main in use.

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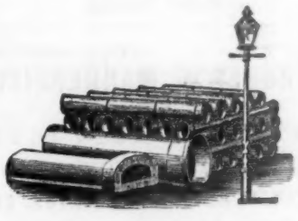

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ALL KINDS OF CASTINGS AND APPARATUS FOR GAS WORKS,

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STOP VALVES, from 3 to 30 inches, for both Water and Gas.

WROUGHT IRON WORK.

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Best quality American Charcoal Iron Boiler Tubes Wrought Iron Tubes from one-eighth of an inch to ten inches diam., with all kinds of Fittings, Valves and Cocks, Gas and Steam Fitters' Tools, and all articles connected with the manufacture of Gas, Steam or Water.

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